Field Review Report:
Mannar Island Wind Power Generation Project

Asian Development Bank

Country: Sri Lanka
Risk category: A
Total project cost: $200 million
Site visit: August 1–18, 2017
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List of Acronyms

ADB	Asian Development Bank
ESIA	environmental and social impact assessment
GoSL	Government of Sri Lanka
IBA	Important Bird and Biodiversity Area
IFIA	International Financial Institutions Act
ha	hectare
km	kilometer
MDB	multilateral development bank
MFF	multitranche financing facility
MW	megawatt
NGO	nongovernmental organization
NREL	National Renewable Energy Laboratory
USAID	United States Agency for International Development
USAID/E3	USAID's Bureau for Economic Growth, Education, and Environment
WPGP	wind power generation project

Executive Summary

Title XIII of the International Financial Institutions (IFI) Act directs the U.S. Government (USG) to strengthen the environmental and social performance of each multilateral development bank (MDB) in which the USG is a shareholder. Toward that objective, the United States Agency for International Development (USAID) leads pre-approval and post-approval field reviews of selected MDB projects in consultation with the Departments of the Treasury and State and relevant U.S. federal agencies.

USAID selects projects for pre-approval review that are particularly likely to have significant adverse impacts on the environment, natural resources, public health or indigenous peoples. The purpose of these reviews is to provide recommendations as to measures, including alternatives that could avoid or mitigate adverse impacts.

This report contains the pre-approval review of the proposed Mannar Island Wind Power Generation Project (WPGP) in northern Sri Lanka.[1] Because of the interdependence of the previously approved 220-kilovolt Mannar-Nadukuda transmission line[2] and Mannar Island WPGP and potential cumulative impacts, USAID included the transmission line in its review. Both projects are located in the Central Asian Flyway for migratory birds, with 7.5 kilometer (km) of the 29-km transmission line passing through the Vankalai Sanctuary with Ramsar Convention designation for internationally important wetlands. To meet ADB's critical habitat safeguard requirement of no net loss or a net gain of the affected biodiversity,[3] construction for both projects will not commence until a biodiversity management plan, encompassing Adam's Bridge National Park, Mannar Island, and Vankalai Sanctuary,[4] has been approved.

The Mannar-Nadukuda transmission line and Mannar Island WPGP support the Government of Sri Lanka's (GoSL) goal to diversify its energy sources and ensure that the portion of electricity produced by renewable energy sources is increased to 20 percent of the total generation power by 2020. The ADB is supporting Sri Lanka's efforts through the Green Power Development and Energy Efficiency Improvement Investment Program and a proposed project loan for the Mannar Island WPGP.

[1] The project was approved for ADB financing in October 2017. The U.S. Government abstained on the vote.
[2] The Mannar-Nadukuda transmission line required to evacuate power from the WPGP, planned 375-megawatt (MW) wind generation projects in the Mannar region of Sri Lanka, was approved for financing in 2016.
[3] ADB Safeguard Policy Statement (2009): "The borrower/client will need to identify measures to avoid, minimize, or mitigate potentially adverse impacts and risks and, as a last resort, propose compensatory measures, such as biodiversity offsets, to achieve no net loss or a net gain of the affected biodiversity."
[4] Since the Vankalai Sanctuary is a legally protected area, the project is required to promote and enhance the conservation aims of the protected area.

The site visit included the area of the Mannar-Nadukuda transmission line, including the portion that traverses the Vankalai Sanctuary, and the location for the proposed 100-MW Mannar Island WPGP. Comments in this report reflect the views of semi-structured interviews with stakeholders (including ADB project team, ADB consultants, GoSL ministries and agencies, civil society organizations, and researchers with expertise in conducting bird and bat assessments for wind farms). USAID's recommendations are based on site-visit observations, discussions, and environmental documentation available at the time of the site visit or shortly afterward.

Soon after the August 2017 field visit,[5] USAID developed its top line recommendation to conduct a 3rd party expert review of the entire project (including the transmission line and wind farm) to identify knowledge gaps and provide recommendations for a supplementary avian and bat migratory and resident population assessment to guide future project decisions. USAID discussed this recommendation with the U.S. Department of the Treasury, the U.S. Office of the Executive Director to the ADB, and the ADB project team prior to the board vote on the Mannar Island WPGP in October 2017. ADB's conclusions diverged from those of USAID on the adequacy of the baseline data collected for the wind farm assessment and the efficacy of the mitigation measures implemented. Despite differing views, following the board meeting, ADB hired international consultants to advise on and support pre-construction survey, monitoring and development of the biodiversity management plan. External consultants will also be employed to monitor the project, contributing to USAID's recommendations.

USAID has made significant efforts to incorporate into this report new information and emergent conditions since the August field visit. Considering the dynamic nature of the project and the context, USAID anticipates that information and perhaps findings and recommendations of this report will be overtaken by events after it is publicly disclosed.

Summary of Findings and Recommendations

Finding 1: The Mannar Island WPGP and Mannar-Nadukuda transmission line are located in or adjacent to internationally recognized, ecologically sensitive, high value biodiversity areas – Adam's Bridge National Park, Vankalai Sanctuary (a Ramsar Convention site) and Vedithalativu Nature Reserve – that are used by migratory birds along the Central Asian Flyway and resident birds and bats. The projects are also in proximity to Giant's Tank Sanctuary, designated as an Important Bird and Biodiversity Area (IBA) by Birdlife International.

Finding 2: Baseline data and analysis presented in the Mannar Island WPGP and Mannar-Nadukuda transmission line environmental and social impact assessments (ESIAs) are not sufficient for USAID to concur with the ADB's conclusion that the projects meet its safeguard criteria for supporting projects in critical habitat in that: 1) there are no measurable adverse impacts, or likelihood of such, on the critical habitat which could impair its high biodiversity value or the ability to function; and 2) the project is not anticipated to lead to a reductions in populations of endangered species such that the persistence of a viable and representative host

[5] Although USAID prefers early engagement on pre-approval reviews, these reviews may occur at any time in the MDB project cycle from concept to board vote. This review was conducted toward the end of the project preparation phase, with recommendations provided to ADB just over a month before the board vote.

ecosystem be compromised.[6] Insufficient baseline data make it difficult to analyze impacts associated with these complex and sensitive ecological migration systems, and thus for the project proponents to propose effective avoidance and/or mitigation measures. Collision risk modeling conclusions are only as robust as the data and parameters within the model.

Project Specific Recommendation for Finding I and Finding 2:

For highly complex and sensitive projects, the ADB's safeguard policy calls for independent advisory panels of experts not affiliated with the project to advise project proponents during project preparation and implementation. Due to the significant biodiversity assets in the project area and the importance of conserving bird migrations, USAID considers that this is a highly complex and sensitive project, although it is not categorized as such by ADB.[7] As such, the ADB should consider establishing an independent advisory panel of experts to review both projects (the Mannar Island WPGP and Mannar-Nadukuda transmission line). The panel would be expected to identify knowledge gaps, and recommend supplementary studies of birds and bats to guide subsequent decisions for both projects. The independent advisory panel should work closely with the GoSL Department of Wildlife Conservation to enhance staff capacity in this sector.

Finding 3: The ADB financed the Mannar Island WPGP and the Mannar-Nadukuda transmission line under two separate financing modalities. As a consequence, the ESIA analysis, review and approval process of both projects was divided into two segments, with the transmission line approved for financing almost one year prior to the completion of the wind farm ESIA. Since the projects are interdependent, this process resulted in the strong likelihood that the wind farm would be approved for financing. As connected, interdependent activities, it is critical to analyze alternatives, assess cumulative impacts, and determine avoidance and other mitigation measures of both projects combined to ensure the environmental soundness of all components of the entire project.

Project Specific Recommendations:

a. The ADB should have expanded the alternatives analysis to include new information concerning the environmental sensitivity of Mannar Island, and compare it with other areas in Sri Lanka's Northern Province or nearby provinces where wind generation could be economically feasible and where biodiversity loss threats could be less significant. For future projects, ADB should ensure that a robust alternatives analysis is conducted.
b. The ADB should have expanded the cumulative impacts assessment to assess associated infrastructure and increased development on Mannar Island. If the evacuation capacity of

[6] ADB Safeguard Policy Statement (2009): "No project activity will be implemented in areas of critical habitat unless the following requirements are met: (i) There are no measurable adverse impacts, or likelihood of such, on the critical habitat which could impair its high biodiversity value or the ability to function. (ii) The project is not anticipated to lead to a reduction in the population of any recognized endangered or critically endangered species or a loss in area of the habitat concerned such that the persistence of a viable and representative host ecosystem be compromised. (iii) Any lesser impacts are mitigated in accordance with para. 27."

[7] "Highly Complex and Sensitive Projects" are projects that ADB deems to be highly risky or contentious or involve serious and multidimensional and generally interrelated potential social and/or environmental impacts.

the transmission line remains at 300 MW, expand the cumulative impacts assessment to include the development of infrastructure required to generate the additional 200 MW.

General Recommendations:

a. The ADB should ensure that when interdependent projects are segmented for financing operations, the baseline data collection, impact analysis (direct, indirect, induced, cumulative and associated facilities) and mitigation measures of the entire suite of projects captures all relevant information for decision-making purposes. This practice supports international ESIA best practice to achieve project objectives while minimizing environmental and social impacts. Current practice can lead to the approval of one project segment before the environmental and social impacts of the entire project are thoroughly analyzed.
b. The GoSL, with donor support, should consider conducting a national level cumulative impacts assessment on the major coastal areas considered important for migratory species, especially those threatened by existing and future development to help inform avoidance and other mitigation measures.

Finding 4: Although there is incomplete knowledge of the adverse environmental impacts to which migratory birds along the Central Asian Flyway are subject, threats from urban, agricultural and industrial development are increasing. At a minimum, these impacts will ultimately reduce available habitat and increase stress to migrating bird populations.

General Recommendations:

a. The GoSL, with ADB support, should engage with other entities (e.g., Global Environmental Facility, International Union for the Conservation of Nature [IUCN], Bonn Convention Secretariat, etc.) to develop a national monitoring program that would provide early warning mechanisms for potential adverse cumulative impacts along the migratory bird routes within Sri Lanka; and to support the establishment of the Central Asian Flyway Site Network with Sri Lankan participation.
b. The ADB should consider developing guidelines for the assessment, avoidance and mitigation of potential impacts in global migratory flyways from the construction and operation of wind farms and associated facilities. The guidelines should specify key factors to be assessed in deciding whether or not to proceed with a project under consideration, and they may specify minimum standards for ADB financing of such projects and/or conditions in which ADB would typically not finance such projects. The ADB should also explore whether it might develop/support projects that would aim to identify and protect global flyways in borrowing countries.

INTRODUCTION

USAID Legal Mandate

Title XIII of the International Financial Institutions (IFI) Act directs the U.S. Government (USG) to strengthen the environmental and social performance of each multilateral development bank (MDB) in which the USG is a shareholder: African Development Bank, Asian Development Bank, European Bank for Reconstruction and Development, Inter-American Development Bank, the World Bank Group. Toward that objective, the United States Agency for International Development (USAID) leads pre-approval field reviews of selected MDB projects in consultation with the Departments of the Treasury and State and relevant U.S. federal agencies.

USAID selects projects for pre-approval review that are particularly likely to have significant adverse impacts on the environment, natural resources, public health or indigenous peoples per Title XIII Section 1303(a)(1) and (3). The purpose of these reviews is to provide recommendations as to measures, including alternatives that could avoid or mitigate adverse impacts.

If not classified, the information collected during these reviews is made available to the public.

Scope of Field Review

USAID frames its analysis from relevant U.S. legislation,[8] MDB safeguard policies and associated guidance, and international best practice standards. Analysis may focus on any aspect of environmental and social assessment and management including, but not limited to: screening; scoping; definition of the project area; assessment of borrower capacity for environmental and social management; analysis of alternatives; baseline data; direct, indirect, and cumulative impacts; and impacts from associated facilities. USAID may particularly focus on environmental and social issues formally raised to MDBs by the USG through policy reviews or other processes. Findings and recommendations of this field review may highlight good practice as well as areas for improvement, such as additional alternatives and means to identify, avoid, and mitigate adverse impacts.

METHODS

The methodological aim of this review was to understand key environmental issues from a diversity of perspectives. The field review team triangulated methods as much as was practical by using multiple data and information collection techniques, multiple sources, and multiple analysts.

Data and information collection techniques included:

[8] Relevant U.S. legislation includes Title XIII of the IFI Act and subsequent appropriations laws that refer to Title XIII.

- Identification and review of project documents, MDB policies, conservation organization reports, documents from related MDB and bilateral development projects, technical literature, and academic literature;
- Interviews with selected subject-matter experts;
- Semi-structured and open-ended interviews with stakeholders; and
- Biophysical observations in and around the project area.

Because of the interdependence of the Mannar-Nadukuda transmission line and the Mannar Island Wind Power Generation Project (WPGP) and potential cumulative impacts, USAID reviewed both projects jointly. The August 2017 site visit[9] included the area of the previously-approved Mannar-Nadukuda transmission line, including the portion that traverses the Vankalai Sanctuary, and the location for the proposed 100-megawatt (MW) Mannar Island WPGP. The trip included meetings with the ADB project team, ADB consultants, Government of Sri Lanka (GoSL) ministries and agencies, including Ceylon Electricity Board (the project sponsor), civil society organizations and researchers with expertise in conducting bird and bat assessments for wind farms. The visit focused on the biodiversity elements of the projects because of threats to these significant assets and the importance of conserving bird migrations as phenomena of abundance.[10] Both projects are located in the Central Asian Flyway for migratory birds, and the transmission line traverses the Vankalai Sanctuary, a designated Ramsar Convention site for internationally important wetlands.

Subsequent findings and recommendations apply to both projects unless otherwise specified. This report also reviews the Mannar Island WPGP Environmental and Social Impact Assessment (ESIA) as it relates to Title XIII Section 1307, including technical sufficiency of the analysis of alternatives and cumulative impacts assessment. USAID's recommendations are based on site visit observations, discussions with stakeholders and experts, and environmental documentation available at the time of the site visit or shortly thereafter.

BACKGROUND: MANNAR ISLAND WIND POWER GENERATION AND MANNAR-NADUKUDA TRANSMISSION LINE PROJECTS

The GoSL's overall goal is to diversify its energy sources and ensure that the portion of electricity produced by renewable energy sources (e.g., mini-hydropower, wind, solar, and biomass) increases to 20 percent of total power generation by 2020. The ADB is supporting the development of renewable energy in Sri Lanka through the Green Power Development and Energy Efficiency Improvement Investment Program, a multitranche financing facility (MFF), in which the first tranche was financed in 2014.

[9] Although USAID prefers early engagement on pre-approval reviews, these reviews may occur at any time in the MDB project cycle from concept to board vote. This review was conducted toward the end of the project preparation phase, with recommendations provided to ADB just over a month before the board vote.
[10] Phenomena of abundance refers to notable behaviors and processes, such as mass movements of wildlife, movements through ancient pathways, and mass aggregations at wintering, breeding, and stopover sites. Weeks et al., Statutory Reform to Protect Migrations as Phenomena of Abundance. Maurer School of Law: Indiana University (2011)

The MFF is intended to focus on the green power development portion of the energy sector to encourage private sector investment in renewable power generation by improving transmission infrastructure. The MFF was designed to support the development of hydropower generation and the proposed wind power park in the Mannar region by financing relevant power evacuation transmission infrastructure.

Mannar Island was identified as a high wind resource potential area based on early studies conducted by the National Renewable Energy Laboratory (NREL).[11] Mannar Island and Jaffna received the lowest ranked score of the five sites evaluated.[12] The NREL study did not recognize the importance of the region as part of the international Central Asian Flyway for migratory birds, and the designation of both the Ramsar Convention site (Vankalai Sanctuary) and Adam's Bridge National Park had not yet occurred.[13] Therefore, at the time of the NREL evaluation, the Mannar Island site ranked high[14] on environmental sensitivity based on the findings that there were "few wildlife refuges, etc., in proximity." At present, the Mannar Island would likely receive a lower ranking score for environmental sensitivity. While the conservation status of the surrounding landscape has been upgraded since 2003 to recognize the international importance of the area for migratory birds, the NREL study has not been updated to reflect the environmental sensitivity of the area. Developers continued to use the NREL study to guide wind power development decision-making.

The proposed 100-MW wind farm will be located in the southern part of the island, between Thoddaveli and Palavi, extending about 12.5 km along the coast. A maximum of thirty-nine turbines are planned to be installed during this phase. The proposed wind farm excludes areas within Adam's Bridge Marine National Park. Infrastructure generating an additional 200 MW could be developed on the Island at a later stage.[15] Electricity generated by the 100-MW wind farm will be evacuated through the 220-kilovolt Mannar-Nadukuda transmission line.

The 220-kilovolt Mannar-Nadukuda transmission line, approved for financing in 2016, is required to evacuate power from the wind generation projects in Mannar region (as much as 300 MW has been considered on Mannar Island and 75 MW is being considered along the coast extending toward Silavaturai on the mainland). The 29-kilometer (km) transmission line passes through the Vankalai Sanctuary for 7.5 km. The Vankalai Sanctuary was declared a Ramsar Convention site in 2010. The site is a critical source of food and habitat for a large number of migratory and resident waterbird species. Annual migrants use the sanctuary arriving and exiting Sri Lanka via the Central Asian Flyway. The sanctuary is also a significant overwintering

[11] NREL is the U.S. Department of Energy's primary national laboratory for renewable energy and energy efficiency research. NREL Sri Lanka Wind Farm Analysis and Site Selection Assistance Report from NREL (SR-710-34646) (2003)

[12] The five sites are: Southeast Coast–Hambantota to Buthawa, West Coast–Kalpitiya Peninsula, Mannar Island, North Coast–Jaffna District, and Central Province–Ambewela area.

[13] NREL (2003). Vankali Sanctuary was identified as a Ramsar Convention site in 2010, and Adam's Bridge was declared a national park in 2015.

[14] Based on a ranking from 1 to 5, a high ranking meant that the site was not environmentally sensitive. NREL (2003)

[15] The ADB stated in a letter to the NGO Policy Forum and Centre for Environmental Justice (October 19, 2017) that additional build-out appears unlikely. However, given that the transmission line will be sized to evacuate 300 MW of electricity, there is still considerable potential for additional development through other financiers.

site for migratory birds. It harbors more than 20,000 waterbirds in a given year, including the northern pintail (*Anas acuta*), greater flamingo (*Phoenicopterus roseus*) and the Eurasian wigeon (*Anas penelope*). It also supports one percent of the global population of the greater flamingo and the Eurasion wigeon. The site's coastal and marine ecosystems are important for over 60 species of fish, marine turtles, and rare species such as dugongs (*Dugong dugon*).[16]

Prior to ADB engagement, the Mannar Island WPGP and Mannar-Nadukuda transmission line were originally approved by the GoSL based on an Initial Environmental Examination with inadequate ornithological surveys and were initially proposed to ADB as Category B. The ADB required the GoSL to undertake an ESIA and conduct bird vantage point surveys for both projects.

Both projects are located in or adjacent to three important ecological and biodiverse areas used by resident and migratory birds and bats,[17] and they are in proximity to an Important Bird and Biodiversity Area (IBA).[18] Due to significant anticipated project impacts to endangered, migratory and congregatory bird species that trigger critical habitat, the project is proposing a package of mitigation measures to satisfy the ADB's safeguard requirement for supporting projects in critical habitat and to avoid any net loss to critical habitat species through promoting the conservation aims of Vankalai Sanctuary, Adam's Bridge National Park, and Mannar Island through the development of a biodiversity management plan.[19,20,21] Mitigation

[16] Ramsar Convention, www.ramsar.org

[17] Although the species of bats identified are not considered threatened, studies have shown that wind farms can significantly reduce bat populations. Best practice requires using acoustic surveys, radar, and/or mist netting to survey bats as they are primarily nocturnal species. There are four species of bats on Mannar Island--three species of Microchiroptera (insectivorous) and one species of Megachiroptera (fruit bats). There are four roosts of flying foxes (*Pteropus spp.*) reported on Mannar Island, one within a few km of the wind farm. The three species of insectivorous bats, play a significant role in controlling insect populations, including agricultural pests. The other species of bat plays an important role in pollinating and dispersing seeds, helping to regenerate plant growth in the ecosystem. These animals may be expected to fly around the island foraging and thus are at high risk of experiencing adverse impacts from the wind farm. Best practice survey methodologies identified above for bats were not used to determine whether the wind farm would pose a significant risk to bats. Tracking studies of a sample of animals is necessary to understand their precise movements and seasonal variations in direction.

[18] A Birdlife International designation includes areas that are: 1) places of international significance for the conservation of birds and other biodiversity; 2) recognized world-wide as practical tools for conservation; 3) distinct areas amenable to practical conservation action; 4) identified using robust, standardized criteria; and 5) sites that together form part of a wider integrated approach to the conservation and sustainable use of the natural environment. www.birdlife.org

[19] ESIA Wind Power Generation Project (RRP SRI 49345) (Pg 9) "A Biodiversity Management Plan (BMP) will be implemented by the Department of Wildlife Conservation in partnership with CEB for the Vankalai Sanctuary and the wind farm area to ensure no net loss of biodiversity and to promote the conservation objectives of the sanctuary and also in accordance with the requirements of ADB's SPS 2009." (2017)

[20] ADB Safeguard Policy Statement (2009): "The borrower/client will need to identify measures to avoid, minimize, or mitigate potentially adverse impacts and risks and, as a last resort, propose compensatory measures, such as biodiversity offsets, to achieve no net loss or a net gain of the affected biodiversity."

[21] ADB Environment Safeguards A Good Practice Sourcebook Draft Working Document (2012): (pg 49) "For projects with potentially significant biodiversity impacts and risks (e.g. involving critical habitats), the development of a Biodiversity Action Plan (BAP) or its equivalent may be appropriate. Regardless of whether proposed biodiversity management measures are presented in a separate plan, mitigation measures and associated timelines for addressing biodiversity issues should be incorporated into the environmental assessment, and implemented through the borrower/client's EMP [Environmental Management Plan]."

measures will include a biodiversity management plan for these areas, with funding for the plan's implementation for only the first five years. The biodiversity management plan is being prepared by an ADB consultant team with the draft expected to be submitted for ADB and the Department of Wildlife Conservation's approval by the second quarter of 2018. The biodiversity management plan will address the potential impacts of the Mannar-Nadukuda transmission line and the Mannar Island WPGP to ensure compliance with the biodiversity requirements of ADB's Safeguard Policy Statement (2009). The ADB expects that the capacity of the Department of Wildlife Conservation will be strengthened through the first five years' implementation of the biodiversity management plan.[22]

Physical civil work activities of both the Mannar-Nadukuda transmission line (the 7.5-km line within Vankalei Sanctuary) and the Mannar Island WPGP will not commence until the following two conditions are fully met:

i. the biodiversity management plan including construction method statement is endorsed by the Department of Wildlife Conservation and agreed by ADB; and
ii. pre-construction avian monitoring surveys conducted from February to April 2018, and from September 2018 to January 2019.

The purpose of the pre-construction surveys are to supplement the baseline data for both the transmission line and wind farm projects and provide inputs to the radar detection system for establishing optimized protocols of wind turbine curtailment. The proposed surveys are expected to provide a baseline of bird flight activity that will assist in developing the radar system. International ornithologists are engaged to oversee avian data collection and ensure it is in accordance with international guidelines. International consultants will also be employed to ensure incorporation of appropriate ornithological inputs to the radar system.

Additionally, through ADB's involvement, bird deflectors will be placed for the transmission line going through the Vankalai Sanctuary.[23]

Below are brief descriptions of Vankalai Sanctuary, Adam's Bridge National Park, Vedithalativu Nature Reserve and Giant's Tank Sanctuary.

1. Vankalai Sanctuary: The Vankalai sanctuary and the wetlands within the Mannar Island are inhabited by a large number of waterbird species, including annual migrants traveling on the Central Asian Flyway. Waterbird species, in addition to other migratory bird species, use this area as an entry point to Sri Lanka, a major wintering site as well as the staging point before they exit from Sri Lanka. More than 30 percent of the bird species recorded in Sri Lanka (more than 150 species) have been recorded from this region. In addition, the Vankalai Sanctuary and Mannar Island support a number of bird species that are restricted

[22] Implementation of the biodiversity management plan will be funded by ADB for the first five years. Ultimately, the Department of Wildlife Conservation will be the lead implementer of the biodiversity management plan and will facilitate collaboration with the Ramsar Convention Secretariat for the development and operation of the plan.
[23] USAID recommends that the bird deflectors should be installed along the entire length of the line not just the section that goes through the Vankalai Sanctuary.

to the northern region of Sri Lanka or seldom recorded outside the northern region of Sri Lanka. Although the numbers vary, the area typically harbors more than 20,000 waterbirds during the migratory season. For example, the Ceylon Bird Club recorded in one migratory season at least 90-100,000 pintails (*Anus spp*.) south of the Talladi-Vankalai Road and, in another migratory season, 200,000-250,000 pintails in the Mannar Kora Kulam area.

Vankalai Sanctuary was designated as Sri Lanka's fourth Ramsar Convention site, a wetland of International Importance in 2010 under the Convention on Wetlands based on the area supporting more than one percent of the total population of at least three species of waterbirds: greater flamingo *(Phoenicopterus roseus*), Eurasian wigeon *(Anas penelope*) and black-tailed godwit (*Limosa limosa*).

The Periyakalapuwa mouth IBA, located within the Vankalai Sanctuary Ramsar Convention site, includes 800 hectare (ha) of saltmarsh and other wetland habitat. The key IBA trigger species[24] is its wintering curlew sandpiper *(Calidris ferruginea*) population (International Union for the Conservation of Nature [IUCN] Red List "near threatened").

2. Adam's Bridge Marine National Park: Adam's Bridge is a chain of limestone shoals that loosely connect Rameswaram Island, off the southeastern coast of Tamil Nadu, India, and Mannar Island. It is a critical breeding site for ground nesting sea birds. Adam's Bridge is a key passage used by thousands of migratory birds that arrive through the eastern Indian route to Mannar Island. It is believed that many weak-fliers follow the Rameswaram to Adam's Bridge to enter Sri Lanka through Mannar Island. Hence, the island chain plays a vitally important role for migratory birds to Sri Lanka.

3. Vedithalativu Nature Reserve: The Amaipaddukai IBA, within the Vedithalativu Nature Reserve, is located near the Mannar town. The Amaipaddukkai IBA, approximately 500 ha of mangroves and salt marshes, is designated as an IBA for the curlew sandpiper population, in addition to holding internationally important numbers of other shorebird species. In 2010, over one million shorebirds were counted in a single day in the Vedithalativu lagoon.[25]

4. Giant's Tank Sanctuary IBA: Giant's Tank, a manmade water storage pond, is approximately 20 km southeast of Mannar Island. Numerous species of waterbirds and shorebirds are found in the area. The IBA designation is based on the presence of Eurasian wigeon and black-headed ibis (*Threskiornis melanocephalus*).

[24] Trigger species are those for which IBA sites are designated.
[25] Ceylon Bird Club Notes (February 2010)

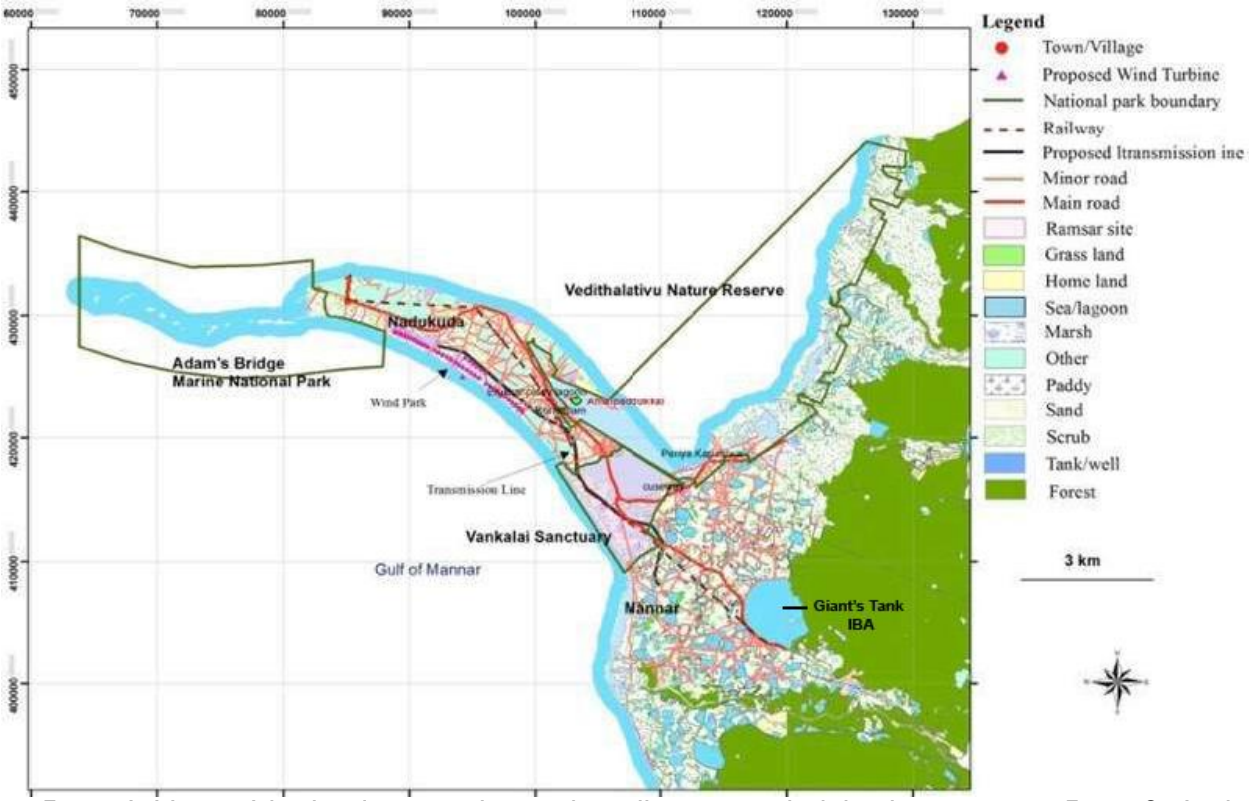

Figure 1: Mannar Island and surrounding ecologically sensitive, high biodiversity areas. From: Sri Lanka: Wind Power Generation Project, Environment Impact Assessment (Draft). (September 2017)

FINDINGS AND RECOMMENDATIONS

<u>Finding 1:</u> The Mannar Island WPGP and Mannar-Nadukuda transmission line are located in or adjacent to internationally recognized, ecologically sensitive, high biodiversity areas – Adam's Bridge National Park, Vankalai Sanctuary (a Ramsar Convention site) and Vedithalativu Nature Reserve – that are used by migratory birds along the Central Asian Flyway and resident birds and bats. The projects are also in proximity to Giant's Tank Sanctuary, designated as an Important Bird and Conservation Area (IBA) by Birdlife International.

The Central Asian Flyway is one of nine global migratory bird flyways that has been scientifically recognized, spanning about 30 countries and territories. The flyway covers a continental area of Eurasia, bounded by the Arctic and Indian Oceans. Sri Lanka is the southernmost land mass of the Central Asian Flyway and is the final destination of many migratory birds exiting the eastern and western Indian flyways. Mannar Island is a key entry and staging area for migratory birds during both migration periods. Research conducted in 1983-84 confirmed the importance of this area for movement of migratory birds at the end of the winter season returning back to

the Northern Hemisphere through Mannar Island and the sand bars of Adam's Bridge.[26] However, research on migration between India from the Rameshwaram side across to Mannar Island is limited.

Sri Lanka is a signatory of the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) and a contracting party to the Convention on Wetlands (Ramsar Convention). As a party to both Conventions, Sri Lanka is expected to adhere to the aims and resolutions of both Conventions that relate to planning for energy developments and conservation of coastal habitats to protect migratory and resident species and their habitats.

The fundamental objective of the Bonn Convention is to protect migratory species that cross international borders where conservation deficiencies will affect the measures undertaken by other range states.[27] There are 35 species on the Convention's "unfavorable conservation status list" that have been identified in the Mannar Island area. The Bonn Convention has global guidelines to ensure that developers take into account the precautionary principle in the development of wind farms and transmission lines in areas where they pose a risk to migratory birds and bats. The intent of the Ramsar Convention is to protect wetlands that serve as critical habitats for migratory and resident birds and to ensure their effective management so that the ecological character of the Ramsar Convention sites is preserved. Sri Lanka has six designated Ramsar Convention sites.

Finding 2: Baseline data and analysis presented in the Mannar Island WPGP and Mannar-Nadukuda transmission line environmental and social impact assessments (ESIAs) are not sufficient for USAID to concur with the ADB's conclusion that the projects meet its safeguard criteria for supporting projects in critical habitat in that: 1) there are no measurable adverse impacts, or likelihood of such, on the critical habitat which could impair its high biodiversity value or the ability to function; and 2) the project is not anticipated to lead to a reductions in populations of endangered species such that the persistence of a viable and representative host ecosystem be compromised.[28] Insufficient baseline data make it difficult to analyze impacts associated with these complex and sensitive ecological migration systems, and thus for the project proponents to propose effective avoidance and/or mitigation measures. Collision risk modeling conclusions are only as robust as the data and parameters within the model.

[26] S. Gunasekara. A note on observations of mass migration of avifauna through Adam's Bridge Sri Lanka. Sri Lanka Naturalist Journal Vol: IX, No: 01-02. (2016)

[27] The Bonn Convention identifies two overlapping categories of migratory species. Species that are endangered are listed as Appendix I species. Whereas, species that have "unfavorable conservation status" and "which require international agreements for their conservation and management" are listed in Appendix II. Parties are required to strive toward the conservation and sustainable use of migratory species listed in the Appendices. The Bonn Convention includes a Scientific Council that "oversees and coordinates migratory species research, identifies migratory species in need of protection, and recommends conservation actions." The fundamental principles of the Bonn Convention include paying attention to migratory species whose conservation status is unfavorable and acknowledging the need to take action to avoid any migratory species becoming endangered.

[28] ADB Safeguard Policy Statement (2009): "No project activity will be implemented in areas of critical habitat unless the following requirements are met: (i) There are no measurable adverse impacts, or likelihood of such, on the critical habitat which could impair its high biodiversity value or the ability to function. (ii) The project is not anticipated to lead to a reduction in the population of any recognized endangered or critically endangered species or a loss in area of the habitat concerned such that the persistence of a viable and representative host ecosystem be compromised. (iii) Any lesser impacts are mitigated in accordance with para. 27."

Sufficient baseline data is the underpinning to determine whether ADB's safeguard criteria to support project activities in critical habitat have been met. Insufficient baseline data make it difficult to analyze impacts associated with these complex and sensitive ecological migration systems.The transmission line ESIA acknowledged that data upon which collision risk model results were based were limited (there were "…some issues with regard to the detail of the baseline surveys, particularly their spatial and temporal coverage in relation to the proposed development").[29] The wind farm ESIA conducted additional surveys in an attempt to supplement the original data. Additional vantage point surveys were not conducted for the transmission line. When taken together, both ESIAs posit that, based on the data collected, the project will not a) lead to reductions in populations of threatened species or b) adversely affect critical habitat in ways that would impair its high biodiversity value or ability to function as an international migratory flyway. The discussion below is divided with respect to the two requirements for projects approved in critical habitats.

ADB requirement: 1)There are no measurable adverse impacts, or likelihood of such, on the critical habitat which could impair its high biodiversity value or the ability to function.

The World Bank Group guidelines for wind energy provide general recommendations for baseline data collection and refer to guidelines previously developed such as the U.S. Fish and Wildlife Service's "Land-based Wind Energy Guidelines." [30] The World Bank Group guidelines recommend that where "robust in-country guidelines are not yet developed, international guidelines should be used and should always consider the need for surveys to be site-, species-, and season-specific. Generic risk assessments and mitigation plans are unlikely to be useful or easily transferable between species and locations."[31]

Since Sri Lanka does not have robust guidelines to guide wind farm development, a review of best practice guidance, in addition to relevant research[32] was conducted to inform the scope of data collection and provide illustrative examples that are recommended in this report.

[29] SRI: Green Power Development and Energy Efficiency Improvement Investment Program – Tranche 2 (SRI: 220 kV Mannar Nadukuda Transmission Line Project) Volume 2 of 2 (pg 31) (2016)
[30] World Bank Group Environmental, Health, and Safety Guidelines for Wind Energy (2015)
[31] Ibid.
[32] Wind Turbines and Birds: A Guidance Document for Environmental Assessment. Canadian Wildlife Service Environment Canada (2003); EU Guidance on wind energy development in accordance with the EU nature legislation. European Union (2011); Technical Manual for Evaluating Wildlife Impacts of Wind Turbines Requiring Coastal Permits. New Jersey Department of Environmental Protection (2010); U.S. Fish and Wildlife Service Land-Based Wind Energy Guidelines (2012); Nixon, K.L., et al. Avian and Bat Survey Protocols For Large Wind Energy Conversion Systems in Minnesota. Minnesota Department of Natural Resources (2014); Greening the Wind: Environmental and Social Considerations for Wind Power Development in Latin America and Beyond. World Bank (2011); Bird and Bird Habitats: Guidelines for Wind Power Projects. Ministry of Natural Resources, Ontario, Canada (2011); Guidelines for Conducting Bird and Bat Studies at Commercial Wind Energy Projects. Department of Environmental Conservation, New York (2016); Gregory et al. Bird Census and Survey Techniques in Bird Ecology and Conservation: A Handbook of Techniques (2004); Comprehensive Guide to Studying Wind Energy/Wildlife Interactions. National Wind Coordinating Collaborative Wildlife Working Group (2011); Beston et al. Insufficient Sampling to Identify Species Affected by Turbine Collisions. Jrnl of Wildlife Management 79 (2015); Reducing Avian Collisions with Power Lines. Edison Electric Institute (2012); Avian and Bat Survey Protocols for

Below are areas identified based on expert input, review of best practice guidance and relevant research for which there appears to be inadequate data presented in either the transmission line or wind farm ESIAs. The data areas are grouped into the following categories: temporal, spatial and special considerations.

CONSIDERATIONS REGARDING TEMPORAL DATA COLLECTION:

Increased sampling during migration:

Data collection considerations

Migration takes place in waves and with spatial patchiness; depending on the species, there can be large differences between the patterns and timing of northward and southward migration, and between age and sex classes of different species. With regard to a particular local area on a given day, it is very difficult to predict whether migrants will be present.[33] In Canada, the number of birds migrating have been shown to vary 10-fold or even 100-fold from one day or night to the next, depending largely on weather.[34] This phenomenon is reflected in notes from the Ceylon Bird Club data, which have shown the presence of large numbers of shorebirds at a site one day and their complete absence the next–an observation that has been made repeatedly for years. For example, on one day, more than 200,000 migrant ducks were present, but only a minute fraction of that were present on subsequent days. This phenomenon is also reported in the Mannar Island WPGP ESIA, by the observation of three additional very large duck flocks[35] during the vantage point surveys of the transmission line within the Vankalai Sanctuary Ramsar Convention site.

Consequently, the field survey needs to be sufficiently comprehensive to take this variability into consideration. Data collection should include: 1) surveys at least every week[36] during high migration (e.g., spring and fall migrations periods with use of bird songs and contact calls); 2) nocturnal surveys conducted at least twice during each migration period, with use of radar preferred; and 3) surveys under varying weather conditions to provide better data concerning the use of the rotor swept.[37] One study reported that flight height of several species varied among seasons, indicating that their risk of collision with wind turbines changed throughout the year.[38] Additionally, bird collision risk can vary with species.

Large Wind Energy Conversion Systems in Minnesota. Minnesota Department of Natural Resources and Minnesota Department of Commerce (2014)

[33] Mabey, S.E. Migration ecology: issues of scale and behaviour. Pp. 66–68 in Schwartz, S.S. (Ed.): Proceedings of the wind energy and birds/bats workshop: understanding and resolving bird and bat impacts, Washington, DC (May 18–19, 2004)

[34] Richardson, W.J. Bird migration and wind turbines: migration timing, flight behaviour and collision risk. (2000); Proceedings of National Avian-Wind Power Planning Meeting III, San Diego, California (May 1998)

[35] These were all recorded on 29/11/15; 60,000 Eurasian wigeon, 30,000 northern pintail and 10,000 garganey. (para 85, pg 31) ESIA Wind Power Generation Project (RRP SRI 49345)

[36] Scottish Natural Heritage Guidance: Survey Methods for Impacts of Onshore Communities. (2005)

[37] Rotor swept is the area through which the rotor blades of a wind turbine spin, as seen when directly facing the center of the rotor blades.

[38] Wulff, S.J., et al. Assessment of Diurnal Wind Turbine Collision Risk for Grassland Birds on the Southern Great Plains. Jrnl of Fish and Wildlife Management (2016); Marques et al. Understanding bird collisions at wind farms: An updated review on the causes and possible mitigation strategies. Biological Conservation 179 (2014); Johnston et al. Increased flight altitudes among migrating golden eagles suggest turbine avoidance at a Rocky Mountain wind installation. PLoS ONE 9. (2014)

Specific behavior and flight behaviors change due to foraging patterns, time of day, weather conditions and migration activity.[39] It is also important to identify significant staging areas as ecological conditions and bird behavior change with migration period.

Baseline information deficiency

Based on information presented in the transmission line and wind farm ESIAs, at a minimum, surveys were not conducted on a weekly basis throughout both migration periods. The ESIA for the transmission line acknowledged the limited vantage point survey data available for conducting the collision risk model.[40] However, the wind farm ESIA conducted additional vantage point surveys in an attempt to supplement the original data. The wind farm vantage point surveys were not conducted on a weekly basis and are only for a single year. In addition, they do not cover April, a time when birds are also migrating. Additional vantage point surveys were not conducted for the transmission line.

Importance of multi-year assessments for both migrant and resident species:

Data collection considerations

There are variations of timing, local movements, directions travelled and altitudes of birds between years, depending on a variety of factors along the migration route, including wind direction, storms and other weather anomalies, food availability and disturbance, among other factors. The Ceylon Bird Club data for this region have shown year-to-year variation in the species and numbers of birds that use this area for migration. Maintaining inter-year flexibility of choice for suitable habitat for species is therefore important and critical for their long-term survival. These differences are important to ascertain. For example, in the coastal bottleneck area, birds may be forced to adopt slightly different patterns between years and seasons, using the north coast of Mannar Island in preference to the south in some years and vice versa. The critical species habitat under the safeguards is triggered for the wind farm site based on the presence of identified critical species, although the wind farm site is not directly used by any of these birds as a habitat.

[39] Ferrer et al. Weak relationship between risk assessment studies and recorded mortality in wind farms. J. Appl. Ecol. 49. (2012)

[40] ESIA: Vantage point surveys are designed to quantify bird flight activity through a study area and identify any important flight routes. Its primary purpose is to provide input data for the Collision Risk Model (Band et al. 2007), which predicts mortalities from collision with turbines. Data can also be used to provide an overview of bird usage of the site, which may help to inform an overview of potential disturbance and displacement. However, the data gathered on target species other than those for Collision Risk Modelling may be biased (see section 3.8.2.1). Where new above-ground grid connections are planned, the proposed connection route should be covered by vantage point observations to assess potential collision risk. The initial vantage point surveys were limited, as they were primarily designed to provide sample data on visible bird migration over the study area. They covered only a small proportion of the survey area (and of the potential impact zone of the development, for both the wind farm and the power line). They also only covered a short period (February-April 2014 and October-November 2015). "The low total amount of survey time at each transmission line vantage points over only a small number of survey-days, means that even a single observation can skew the results, and makes the results less reliable. The results for Spot-billed Pelican, for example, likely over-estimate the actual risk to this species. Similarly, less frequent events of importance may have been missed as a result of the sampling strategy." (ESIA: Mannar Wind Farm, Northern Province, Sri Lanka: Avian Collision Risk Assessment. Pg 31) (2017)

Baseline information deficiency

- Based on the surveys conducted for the wind farm ESIA, it is not clear how the assessment determined that endangered and other species would not overfly the wind farm area, during seasonal, daily or annual migration, by night or day. Overflight constitutes "direct usage" of the air space, and therefore, it is considered to be critical habitat, even if the birds are not feeding or nesting in the area.
- The wind farm ESIA recognizes the high variability from year to year for bird populations.[41] However, data collection methods did not take this into account, as only limited vantage point surveys were conducted.

Weather conditions:

Data collection considerations

Studies have shown that certain weather conditions (e.g., strong winds impacting flight maneuverability, reduced visibility) increase the occurrence of collisions with artificial structures. Collisions by nocturnal migrants tend to occur during poor weather conditions with low visibility. Studies have shown that birds may be forced to lower their flight altitude if they encounter bad weather during migration.[42] A cloud ceiling that drops to near or below the height of the turbines will induce birds to fly at or below treetop level, therefore increasing the probability of collisions. It is important to understand whether there were coastal species flying further inland during higher wind or poor weather conditions.

Baseline information deficiency

- While information on wind direction and speed is included in the transmission line and wind farm ESIAs, it is not clear how this information was taken into account during these assessments.

CONSIDERATIONS REGARDING SPATIAL DATA COLLECTION:

Daily/local movement of waterbirds:

Data collection considerations

The Mannar area is internationally important for a high diversity and abundance of waterbirds that use the intertidal areas mainly on the north and northeast of Mannar Island, with some on the western end. As large flocks of birds feed during the low tide, they undertake daily movements between feeding and roosting areas in relation to the tidal cycle. Therefore, birds may fly around during night and day between feeding and roosting areas, depending on a range of factors, including wind speed and direction, disturbance, etc. Also, gulls and tern species may fly back and forth across the island to take advantage of fishing activities on the north and south coasts of the island. These regular flights can put these species at high risk, not just during the migration season.

[41] ESIA Wind Power Generation Project (RRP SRI 49345) (para 217, pg 88) (2017)
[42] Newton, I. Weather-related mass-mortality events in migrants. Ibis 149. (2007)

Baseline information deficiency

- The data and analysis does not provide the following information that would be important to understand and assess the risk posed to these flocks from the wind farm and transmission line:
    - Resident and migratory bird movement patterns from and to the Vakalai Santuary, Mannar Island, and Adam's Bridge shoals.
    - Data to assess the risk to regular flights of gulls and tern species that benefit from fishing activities of local fisherfolk, both within and outside of the migration season.

Roosting and nesting areas:

Data collection considerations

It is important to determine the presence of any diurnal or nocturnal roost sites of birds within or around the proposed wind farm site. For example, gulls and terns were recorded in high numbers across the long axis of the farm area. The kentish plover (*Charadrius alexandrines)* and red-wattled lapwing (*Vanellus indicus)* are two ground nesting shorebird species in the Mannar area, breeding on sandy beaches and close to the coast respectively.[43] As the wind farm site appears to be suitable habitat for a range of species, there could well be nesting on the site. There does not appear to be any mention in the wind farm ESIA of these or other birds breeding in the area.

Baseline information deficiency

- Given that Caspian, gull-billed and common terns were among the 26 species that triggered the critical habitat criterion,[44] the wind farm ESIA did not provide information on its breeding population in Adam's Bridge National Park and on how adults are moving around and using the north and south coast on a daily basis. There appears to be no assessment of newly-fledged juveniles, who are at higher risk of collision because they are more inexperienced in moving around the area.

CONSIDERATIONS FOR SPECIAL DATA COLLECTION:

Bird species:

Data collection considerations

In addition to threatened species, there are several other categories of birds that require special consideration. These include listed species in Appendix II of the Bonn Convention, which are not highlighted in the ESIAs, and raptor species. In 2014, the Ceylon Bird Club identified five migratory raptor species (booted eagle [*Aquila pennata*], crested honey buzzard [*Pernis ptilorhynchus*], [45] Himalayan buzzard [*Buteo refectus*], brahminy kite [*Haliastur indus*], and white-bellied sea eagle [*Haliaeetus leucogaster*]) on Adam's Bridge.[46] Their presence on Adam's Bridge indicates that they would migrate over Mannar Island to get to the main island. These species were not identified during the limited data collection effort

[43] Both species are migratory/congregatory species and represent more than 1% of the flyway population.
[44] ESIA Wind Power Generation Project (RRP SRI 49345) (pg 9) (2017)
[45] This species is listed in Appendix II of the Convention on the Conservation of Migratory Species of Wild Animals.
[46] Ceylon Bird Club Notes (October 2014)

for the ESIAs. Further surveys are needed to understand more about the migration of raptors in this region and to understand potential impacts of the wind farm and transmission line. The surveys should focus solely on raptors, not conducted at the same time as other bird surveys, as highlighted in best practice guidelines.

Baseline information deficiency

- The ESIAs did not focus specifically on raptors with sightings only recorded during routine data collection.

Local migrants and residents:

Data collection considerations

There is a distinction between resident and migratory birds and bats. Even though there are potential adverse effects on both groups, the risks to each differ spatially and temporally at both the transmission line and at the wind turbines. Similarly, unlike long distance migrants from Central Asia, which has more seasonal migratory movements, there are also local migrant species like the greater flamingo with different local movement migration patterns that need to be studied in more detail. Because the flamingo is a large, long-necked, long-legged bird; is a flocking species that migrates in the day and night; and extensively uses the coastal areas, it should be considered a species at high risk of harm from transmission lines and wind farms. The only satellite telemetry study of birds for this region covers the movement of four tagged individuals of greater flamingos, an important species for this area. All four flamingos have been recorded to move back and forth from India to northern Sri Lanka over the period of two years of study. From the tracking information, it is clear that at least one individual flamingo is using this Mannar area during the non-breeding season (Nov-Dec). This individual is also recorded coming very close (within about two km) to the proposed location of the wind farm. Thus, proposals for closure of wind farm operations during peak migration for other species may not cover the movement patterns of the flamingo (and other local migrants at high risk).

Baseline information deficiency

- There does not appear to be an assessment of potential impacts on local migrating resident species.

Nocturnal assessments:

Data collection considerations

The ESIAs focused on diurnal bird species, and overlooked important information on nocturnal resident species and on diurnal species that are also nocturnal migrants (e.g., waterbirds, landbirds, and raptors). The flight heights of nocturnal migrants are quite variable and not well understood.[47] Because there is a short sea crossing, it may be expected that migratory birds fly at low altitudes and thus may be at risk, but this needs to be assessed. Radar studies should be undertaken for nocturnally migrating birds. Radar

[47] Kingsley, A.; Whittam, B. Wind turbines and birds. A background review for environmental assessment. Environment Canada, Canadian Wildlife Service, Quebec (2005)

samples should be concurrently taken in both horizontal and vertical modes to collect information of target passage rate, flight height, direction, and speed.[48]

Baseline information deficiency

- Based on the earlier limited vantage point survey for the transmission line, it was concluded that nocturnal assessments were not required. Consequently, systematic nocturnal data were not collected for either birds or bats.

ADB requirement: 2) The project is not anticipated to lead to a reduction in the population of any recognized endangered or critically endangered species or a loss in area of the habitat concerned such that the persistence of a viable and representative host ecosystem be compromised.

Collision risk modeling conclusions are only as robust as the data and parameters within the model. While collision risk models address the question of individual mortalities, population models address the question of "what impact will the expected number of mortalities have on the viability of the species or population?"[49] Without this knowledge, "the number of collision mortalities for a threatened species has little value without an understanding of the possible effect the mortalities may have on the viability of the relevant population."[50] Population modeling was not undertaken and the available data are not adequate to determine that, over time, threatened species from anywhere in the sanctuary (not just those spotted in the vicinity of the transmission line) are not affected by the proposed transmission line and wind farm. Relatively small increases in mortality rates may have a significant impact on some populations of birds that are particularly vulnerable species. [51] One study on nesting terns suggested that increases in mortality of greater than 0.5 percent could have serious population impacts.[52] Additionally, cumulative mortality from multiple sources may also contribute to population declines in vulnerable species. Ideally, population models should be used to determine

[48] At the World Bank financed Mexico La Venta II project, a marine radar unit (costing about US$20,000) has been mounted to the back of a pickup truck, and is being effectively used for both spotting approaching daytime bird flocks and for counting nocturnally migrating birds. Marine radar has also been successfully used at several proposed and operational wind farms in the United States (Harmata et al. 1999, Cooper and Day 2004, Mabee and Cooper 2004, Desholm et al. 2006, Mabee et al. 2006). Compared with NEXRAD and tracking radars, marine radar is relatively inexpensive, available off -the-shelf, highly portable, dependable and easy to operate. It also requires little modification or maintenance, has repair personnel readily available worldwide, and has high resolution in both the horizontal and vertical scanning modes. From: Ledec, G., Rapp, K.W., and R. G. Aiello. Greening the Wind: Environmental and Social Considerations for Wind Power Development in Latin America and Beyond. Energy Unit, World Bank. (2011)

[49] "Overall, the determination of simple numbers of mortalities is less important than the impact of collision losses on the viability of threatened fauna populations." in "Wildlife and Wind Farms - Conflicts and Solutions: Onshore: Monitoring and Mitigation: 2 (Conservation Handbooks)" ed. M. Perrow (2017)

[50] Smales, I. Modeling Collision Risk and Populations. from "Wildlife and Wind Farms - Conflicts and Solutions: Onshore: Monitoring and Mitigation: 2 (Conservation Handbooks)" ed. M. Perrow (2017)

[51] Vulnerable species (e.g., large raptors, seabirds, flamingos) are those that are highly susceptible to collision and with low-productivity, making them less able to compensate for increased levels of adult mortality.

[52] Everaert, J., Stienen, E.W.M. Impact of wind turbines on birds in Zeebrugge (Belgium): significant effect on breeding tern colony due to collisions. Biodiversity and Conservation 16; Drewitt, A.L., Langston, R.H.W. 2008: Collision effects of wind-power generators and other obstacles on birds. Annals of the New York Academy of Sciences 1134. (2007)

sustainable mortality limits for populations of threatened species before an assessment of risk for individual wind farms to provide the appropriate context to evaluate predictions of collision risk results.[53] The ADB team interpreted that collision risks below a one percent increase are usually considered not to be significant.[54]

Collision Risk Modeling Considerations

Wind farms and transmission lines can have a critical influence on bird collision risk. Some studies have found that turbines located at the ends of rows, next to gaps in rows, and at the edge of local clusters can kill disproportionately more birds. Other studies have shown that a wind farm arranged perpendicularly to the main flight path may be responsible for a higher collision risk. Yet others have argued that a dense cluster of turbines is potentially less damaging for wintering, feeding and possibly breeding birds because the cluster tends to dissuade them from flying among the turbines. World Bank Group guidelines recommend that surveys "should be designed and implemented to adequately guide the micro-siting of turbines (and turbine selection) to minimize collision risks to birds and bats."[55]

The Band collision risk model was used to determine the risk factor posed to birds by both turbines and the transmission line. For the transmission line, the modelling was limited by the amount of baseline data available from only three vantage points (covering approximately 1.5 km of the 7.5-km route through the Ramsar Convention site) and for surveys covering only a short period of time (February-April 2014, and November 2015). Additional data collection was carried out for the wind farm location, with four vantage points from June 2016 to March 2017. However, data were not collected for all vantage points during this time period, and hours of observation ranged from 3 hours to 24 hours.

Information deficiency

- The Band model assumes all flights are from a single direction, therefore, the model did not include the fact that the birds have the capacity to fly toward a turbine from any angle. Additionally, the Band model only accounts for the danger posed by moving blades and not for other turbine components.[56]

Insufficient Cumulative Impacts Assessment: The primary goal of cumulative impact analysis is to determine the magnitude and significance of the environmental consequences of the proposed action in the context of the cumulative effects of other past, present and future actions.

- Collision modeling for cumulative impacts was undertaken using only the 7.5-km section of the transmission line that passes through the Vankalai Sanctuary Ramsar Convention site. The full length of the transmission line is greater than 29 km. The collision modeling

[53] Smales, I. Modeling Collision Risk and Populations. from "Wildlife and Wind Farms - Conflicts and Solutions: Onshore: Monitoring and Mitigation: 2 (Conservation Handbooks)" ed. M. Perrow (2017)
[54] Information provided through the Office of the United States Executive Director.
[55] World Bank Group Environmental, Health, and Safety Guidelines for Wind Energy (2015)
[56] "Some birds that rarely fly at rotor height are known to fatally strike turbine towers." Smales, I. Modeling Collision Risk and Populations. In Wildlife And Wind Farms - Conflicts And Solutions: Onshore: Monitoring And Mitigation: 2 (Conservation Handbooks)" by M. Perrow (2017)

for cumulative impacts on bird populations should have assessed the full transmission line length, not just 7.5 km.[57] Much of the transmission line, e.g., an additional 22 km from the substation in Nadukuda to the sanctuary boundary, will be adjacent to the Eukkalampiddy Lagoon, where large numbers of birds congregate during the migration season.[58] Data available in the ESIA are not sufficient to conclude that large number of birds do not cross the island from the lagoon toward the Mannar Gulf, or fly inland, and thus encounter the transmission line outside of the Vankalai Sanctuary.[59]

- At the project level, the cumulative impact of a barrier (resulting from the wind turbines) across the coast from the west of the wind farm to the east end of the transmission line where it enters the mainland – should be considered as a continuous barrier to daily local movements and migration in a north-south and east-west directions, both in day and night.

Project-Specific Recommendation for Finding 1 and Finding 2:

For highly complex and sensitive projects, the ADB's safeguard policy calls for independent advisory panels of experts not affiliated with the project to advise project proponents during project preparation and implementation. Due to the significant biodiversity assets in the project area and the importance of conserving bird migrations as phenomena of abundance, USAID considers that this is a highly complex and sensitive project, although it is not categorized as such by ADB.[60] As such, the ADB should consider establishing an independent advisory panel of experts to review both projects (the Mannar Island WPGP and Mannar-Nadukuda transmission line). The panel would be expected to identify knowledge gaps, and recommend supplementary studies of birds and bats to guide subsequent decisions for both projects. The independent advisory panel should work closely with the GoSL Department of Wildlife to enhance staff capacity in this sector.

<u>Finding 3:</u> The ADB financed the Mannar Island WPGP and the Mannar-Nadukuda transmission line under two separate financing modalities. As a consequence, the ESIA analysis, review and approval process of both projects was divided into two segments with the transmission line approved for financing almost one year prior to the completion of the wind farm ESIA. Since the projects are interdependent, this process resulted in the strong likelihood that the wind farm would be approved for financing. As connected, interdependent activities, it is critical to analyze alternatives, assess cumulative impacts, and determine avoidance and other mitigation measures of both projects combined to ensure the environmental soundness of the entire project.

[57] This modelling was limited by the amount of baseline data available, from only three vantage points (covering approximately 1.5 km of the 7.5-km route through the Ramsar site) and for surveys over only a short period of time (February-April 2014, and November 2015).

[58] Also potentially on flight path to Giant's Tank an IBA.

[59] ADB has informed USAID that the pre-construction avian monitoring survey will be conducted by three international ornithologists and local surveyors covering both the transmission line and 100MW wind power projects, and the cumulative impacts from both projects will be further understood through this survey.

[60] "Highly Complex and Sensitive Projects" are projects that ADB deems to be highly risky or contentious or involve serious and multidimensional and generally interrelated potential social and/or environmental impacts.

The segmentation of the one project into separate components (wind farm and transmission line) does not conform to international best practice for ESIAs. The transmission line ESIA was approved in 2016 based on limited baseline data to assess the direct, indirect and cumulative impacts of the transmission line and wind farm on resident and migratory birds and bats. Although ADB has stated that they would only finance the development of the 100-MW wind farm on the island, the transmission line has the capacity to evacuate a total of 300 MW of electricity from the island. This suggests that the remaining 200 MW could be financed by other entities, requiring additional ESIAs with possibly the same data deficiencies.

Incomplete Alternatives Analysis: A thorough, unbiased and transparent alternatives assessment is one of the main tenets of international ESIA policy and the most important contribution the ESIA can make to improving decision-making. The alternative analysis is designed to ensure that environmental and social impacts are taken into account during the decision-making process. In the absence of thorough analyses of alternatives, the ESIA tends to be biased toward supporting or affirming a project proposal.

Absence of analysis that would indicate that Mannar Island is a preferable alternative to the other sites identified by NREL or other project areas for wind power.

- The alternatives analysis did not assess sites identified by NREL or other project areas, outside of Mannar Island to determine if wind generation could be economically feasible and biodiversity loss threats less significant in other sites.
- The alternative analysis did not assess the new operational assumptions of the project with reduction of MW production, inclusion of a radar system to monitor bird migrations through the area, and commitment to shut down turbines during migratory periods.

Insufficient Cumulative Impacts Assessment: The Bonn Convention provides general guidance on cumulative impacts from the United Nations Environment Programme/Convention on the Conservation of Migratory Species Resolution 11.27 on Renewable Energy and Migratory Species, adopted by the Conference of the Parties at its 11th Meeting (2014), and encourages parties to "apply appropriate cumulative impact studies to describe and understand impacts at larger scale, such as at population level or along entire migration routes (e.g., at flyway scale for birds)." Individual wind farms developed in "one country may be acceptable in terms of its impact on migratory species, but the cumulative impact of several developments along the migratory pathway may have significant effects. At national or subnational level these issues are difficult to assess. If the planning process is left to the individual countries alone, cumulative impacts might not be recognised."[61] Additionally, cumulative impacts considerations should contribute to the development and refinement of alternatives and are essential to developing appropriate mitigation and monitoring effectiveness. The analysis needs to be done in sufficient detail to assist the decision-maker.

[61] Convention on the Conservation of Migratory Species (Pg 7) Renewable Energy Technologies and Migratory Species: Guidelines for Sustainable Deployment (2014)

The cumulative impacts assessment, performed to analyze the impacts of increased development that is expected on the island and surrounding area, was inadequate.

- The transmission line is sized to evacuate an additional 200 MW of electricity from Mannar Island, which implies a build out of more wind turbines on the island in the future, with two proposed sites (A and B) identified.[62] Although recognizing the limitations to fully assess the two additional sites that have been identified and ADB's statement that additional build-out appears unlikely, the potential capacity of each site has been proposed and thus should be included in the Mannar Island WGPG assessment.[63] Additionally, increased development on the island is expected due to increased availability of electricity. These foreseeable actions need to be included in the cumulative risk assessment, which should include the use of an updated collision risk model, due to high mortality rates of birds flying into buildings and other towers.
- Cumulative mortality from multiple sources may also contribute to population declines in susceptible species, and relatively small increases in mortality rates may have a significant impact on some populations of birds. When considering potential impacts, it is important to consider the average effect of each turbine, the cumulative effect of the total number of turbines and associated structures, and even the cumulative impact of other wind farms in the range of a bird population, particularly where rare or threatened species are concerned.[64]
- As major coastal developments are being undertaken within Sri Lanka and India, the cumulative impacts of loss of coastal intertidal and supratidal terrestrial and aquatic habitats on migratory birds needs to be assessed. Additionally, wind farms are proposed on the Indian coast, including on Adam's Bridge and elsewhere along the east coast of India.[65]

Project-Specific Recommendations:

a. The ADB should have expanded the alternatives analysis to include new information concerning the environmental sensitivity of Mannar Island, and compare it with other areas in Sri Lanka's Northern Province or nearby provinces where wind generation could be economically feasible and where biodiversity loss threats could be less significant. For future projects, ADB should ensure that a robust alternatives analysis is conducted.
b. The ADB should have expanded the cumulative impacts assessment to assess associated infrastructure and increased development on Mannar Island. If the evacuation capacity of the transmission line remains at 300 MW, expand the cumulative impacts assessment to

[62] ESIA Wind Power Generation Project (RRP SRI 49345): Action Plan: Wind power development in the Mannar region. 30 August 2017 (2017)
[63] Table 32 (pg 137) Cumulative annual collision risk of the transmission line in combination with the Mannar Island wind farm with transmission line mitigation implemented included Phase 2 200-MW wind farm development. The ESIA SRI: Green Power Development and Energy Efficiency Improvement Investment Program Tranche 2 (SRI: 220 kV Mannar Nadukuda Transmission Line Project) (2016)
[64] New Zealand Government, Department of Conservation. Impacts of wind farms on birds: a review. (2009).
[65] Ledec, G., Rapp, K.W., and R. G. Aiello. (2011): Greening the Wind: Environmental and Social Considerations for Wind Power Development in Latin America and Beyond. Energy Unit, World Bank. (pg 20) Cumulative Impacts for Migratory Species." If more wind farms continue to be built along bird migration pathways rather than lower-risk windy areas, the synergistic effect of multiple turbine risk zones experienced by migrating birds—in addition to all the other human-caused risks—may result in significant cumulative mortality."

include the development of infrastructure required to generate the additional 200 MW on the island.

General Recommendations:

a. The ADB should ensure that when interdependent projects are segmented for financing operations, the baseline data collection, impact analysis (direct, indirect, induced, cumulative and associated facilities) and mitigation measures of the entire suite of projects captures all relevant information for decision-making purposes. This practice supports international ESIA best practice to achieve project objectives while minimizing environmental and social impacts. Current practice can lead to the approval of one project segment before the environmental and social impacts of the entire project are thoroughly analyzed.
b. The GoSL, with donor support, should consider conducting a national level cumulative impacts assessment on the major coastal areas considered important for migratory species, especially those threatened by existing and future development to help inform avoidance and other mitigation measures.

<u>Finding 4:</u> Although there is incomplete knowledge of the adverse environmental impacts to which migratory birds are subject along the Central Asian Flyway, threats from urban, agricultural and industrial development are increasing. At a minimum, these impacts will ultimately reduce available habitat and increase stress to migrating bird populations.

Migratory birds are subject to a number of potential challenges and impacts along their migratory routes. These threats include habitat degradation and loss of connection along the chain of important habitats and landscapes that provide an "ecological network" for birds to nest, feed and rest during migration and for non-breeding sites at the terminus of their annual migration.[66]

Information on the status and trends of most migratory bird populations is limited and outdated. The Central Asian Flyway Action Plan for the Conservation of Migratory Waterbirds and Their Habitats calls for the establishment of Central Asian Flyway Site Network. Range States are expected to actively support the establishment of this Network as a mechanism for linking national networks of waterbird sites of international importance across the Flyway. This will be based on the principle of establishing an ecological network of internationally important sites through promotion of conservation and sustainable management of wetlands and other habitats. It is also expected to provide a mechanism to target actions to improve the well-being of local people dependent on the sites.[67]

General Recommendations:

a. The GoSL, with ADB support, should engage with other entities (e.g., Global Environmental Facility, International Union for the Conservation of Nature [IUCN], Bonn Convention Secretariat, etc.) to develop a national monitoring program that

[66] Mundkur, T. Conserving Birds and their Habitats along the Central Asian Flyway. Hornbill (Apr-June 2017) pp 4-11. (2017)
[67] Central Asian Flyway Action Plan for the Conservation of Migratory Waterbirds and Their Habitats (2005)

would provide early warning mechanisms for potential adverse cumulative impacts along the migratory bird routes within Sri Lanka; and to support the establishment of the Central Asian Flyway Site Network with Sri Lankan participation.

b. The ADB should consider developing guidelines for the assessment, avoidance and mitigation of potential impacts in global migratory flyways from the construction and operation of wind farms and associated facilities. The guidelines should identify key factors to be assessed in deciding whether or not to proceed with a project under consideration, and they may identify minimum standards for ADB financing of such projects and/or conditions in which ADB would typically not finance such projects. The ADB should also explore whether it might develop/support projects that would aim to identify and protect global flyways in borrowing countries.